

U.S. Patent Application Serial No. 10/601,803
Response filed August 23, 2005
Reply to OA dated May 23, 2005

AMENDMENTS TO THE CLAIMS:

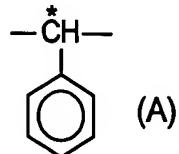
Please amend claim 2, as follows. This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

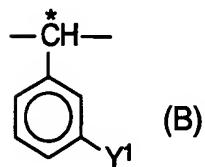
1. (Withdrawn) A method of increasing a helical twisting power HTP (1/ μ m):

$$HTP = 1/(P \times 0.01C)$$

where C represents an amount (% by weight) of an optically active compound and P represents a natural pitch (μ m) in a compound having a partial structure represented by the formula (A):



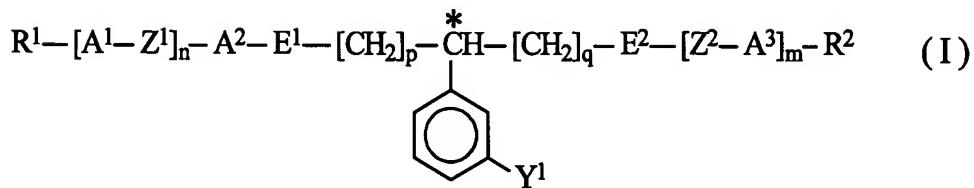
wherein * represents the position of an asymmetric carbon atom, which has an asymmetric carbon atom, said method comprising replacing a partial structure represented by the above formula (A) by a partial structure represented by the formula (B):



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wherein * represents the position of an asymmetric carbon atom, and Y¹ represents an alkyl group having 1 to 10 carbon atoms, an alkenyl group having 2 to 10 carbon atoms, a fluorine atom, a chlorine atom, a bromine atom, an iodine atom, a cyano group or an isothiocyanate group, the alkyl group or the alkenyl group is not substituted or can have one, or two or more fluorine atoms, chlorine atoms, cyano groups, methyl groups or trifluoromethyl groups as a substituent, and one, or two or more methylene groups existing in the alkyl group or the alkenyl group may be substituted with -CO- or may be substituted with an oxygen atom or -COO- in such a manner that oxygen atoms are not directly bonded to each other.

2. (Currently amended) An optically active compound represented by the general formula (I):



wherein * represents the position of an asymmetric carbon,

R¹ and R² each independently represents an alkyl group having 1 to 10 carbon atoms, an alkenyl group having 2 to 10 carbon atoms, a hydrogen atom, a fluorine atom, a chlorine atom, a bromine atom, an iodine atom, a cyano group or an isothiocyanate group, the alkyl group or the

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alkenyl group is not substituted or can have one, or two or more fluorine atoms, chlorine atoms, cyano groups, methyl groups or trifluoromethyl groups as a substituent, and one, or two or more methylene groups existing in the alkyl group or the alkenyl group may be substituted with -CO- or may be substituted with an oxygen atom or -COO- in such a manner that oxygen atoms are not directly bonded to each other,

A^1 , A^2 and A^3 each independently represents a 1,4-phenylene group, a 1,4-cyclohexylene group, a 1,4-cyclohexenyl group, a tetrahydropyran-2,5-diyl group, a 1,3-dioxane-2,5-diyl group, a tetrahydrothiopyran-2,5-diyl group, a 1,4-bicyclo(2,2,2)octylene group, a decahydronaphthalene-2,6-diyl group, a pyridine-2,5-diyl group, a pyrimidine-2,5-diyl group, a pyrazine-2,5-diyl group, a 1,2,3,4-tetrahydronaphthalene-2,6-diyl group, a 2,6-naphthylene group, an indane-2,5-diyl group, a phenanthrene-2,7-diyl group, a 9,10-dihydrophenanthrene-2,7-diyl group, a 1,2,3,4,4a,9,10a-octahydrophenanthrene-2,7-diyl group or a fluorene-2,7-diyl group, and the 1,4-phenylene group, the 1,2,3,4-tetrahydronaphthalene-2,6-diyl group, the 2,6-naphthylene group, phenanthrene-2,7-diyl group, the 9,10-dihydrophenanthrene-2,7-diyl group, the 1,2,3,4,4a,9,10a-octahydrophenanthrene-2,7-diyl group and the fluorene-2,7-diyl group are not substituted or can have one, or two or more fluorine atoms, chlorine atoms, trifluoromethyl groups, trifluoromethoxy groups or methyl groups as a substituent,

Z^1 and Z^2 each independently represents a single bond, -CO-, -COO-, -OCO-, -CH=N-, -N=CH-, -C≡C-, -CH₂CH₂-, -CH₂CH₂CH₂-, -CH₂CH₂CH₂CH₂-, -CH₂O-, -OCH₂-, -CF₂O-, -OCF₂-, -CH=N-N=CH-, -CF=CF-, -CH=CH-, -CH₂CH₂CH=CH-,

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-CH=CHCH₂CH₂- or -CH₂CH=CHCH₂-,

Y¹ represents an alkyl group having 1 to 10 carbon atoms, an alkenyl group having 2 to 10 carbon atoms, a fluorine atom, a chlorine atom, a bromine atom, an iodine atom, a cyano group or an isothiocyanate group, the alkyl group or the alkenyl group is not substituted or can have one, two or more fluorine atoms, chlorine atoms, cyano groups, methyl groups or trifluoromethyl groups as a substituent, and one, or two or more methylene groups existing in the alkyl group or the alkenyl group may be substituted with -CO- or may be substituted with an oxygen atom or -COO- in such a manner that oxygen atoms are not directly bonded to each other,

E¹ and E² each independently represents a single bond, -O-, -CO-, -COO-, -OCO-, -CH₂- , -CH₂CH₂- , -CH₂O-, -OCH₂- , -COCH₂- , -CH₂CO-, -COOCH₂- , -OCOCH₂- , -CH₂COO- or -CH₂OCO- ,

m, n, p and q each independently represents 0, 1 or 2 and, when n represents 2, the two groups A¹ or the two groups Z² may be the same or different, and when m represents 2, the two groups Z² or the two groups A³ may be the same or different, and

n represents 1 or 2 and, when n represents 2, the two groups A¹ or the two groups Z² may be the same or different, and

any oxygen atom in E² and any oxygen atom in Z² are not adjacent to each other.

3. (Withdrawn) The optically active compound according to claim 2, wherein m and q represent 0, E² represents a single bond, and R² represents a methyl group or a trifluoromethyl group.

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4. (Original) The optically active compound according to claim 2, wherein Y^1 represents an alkyl group having 1 to 3 carbon atoms, an alkoxy group having 1 to 3 carbon atoms, an alkenyl group having 2 to 3 carbon atoms, an alkenyloxy group having 2 to 3 carbon atoms, a fluorine atom, a chlorine atom or a bromine atom, and the alkyl group, the alkenyl group, the alkoxy group and the alkenyloxy group are not substituted or can one, or two or more fluorine atoms or chlorine atoms as a substituent.

5. (Original) The optically active compound according to claim 4, wherein m and q represent 0, E^2 represents a single bond, and R^2 represents a methyl group or a trifluoromethyl group.

6. (Original) The optically active compound according to claim 5, wherein p represents 0 and E^1 represents $-CH_2-$, $-O-$, $-CO-$, $-COO-$, $-OCO-$, $-CH_2CH_2-$, $-CH_2O-$, $-OCH_2-$, $-COCH_2-$ or $-CH_2CO-$.

7. (Original) The optically active compound according to claim 5, wherein p represents 0, E^1 represents $-COO-$, and R^2 represents a methyl group.

8. (Original) The optically active compound according to claim 6, wherein A^1 and A^2 each independently represents a 1,4-phenylene group or a 1,4-cyclohexylene group, and E^1 represents $-CH_2-$ or $-COO-$.

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9. (Withdrawn) The optically active compound according to claim 4, wherein n represents 1, m represents 2, and Z¹ and Z² represent a single bond.

10. (Withdrawn) The optically active compound according to claim 9, wherein p represents 0, q represents 1, and E¹ and E² each independently represents -CH₂- , -COO- or -OCO-.

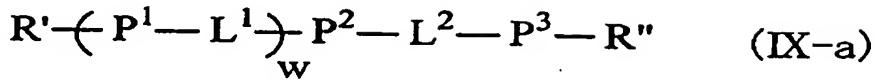
11. (Withdrawn) The optically active compound according to claim 10, wherein A¹, A² and A³ each independently represents a 1,4-phenylene group or a 1,4-cyclohexylene group.

12. (Withdrawn) The optically active compound according to claim 2, wherein Y¹ represents a fluorine atom, a methyl group, a methoxy group, a trifluoromethyl group or a trifluoromethoxy group.

13. (Withdrawn) A nematic or cholesteric liquid crystal composition comprising 0.01% by weight to 50% by weight of the optically active compound of claim 2.

14. (Withdrawn) The nematic or cholesteric liquid crystal composition according to claim 13, comprising a cholesterol derivative or one to five kinds of optically active compounds represented by the general formula (IX-a):

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wherein R' and R'' each independently represents an alkyl group having 1 to 10 carbon atoms, an alkenyl group having 2 to 10 carbon atoms, a hydrogen atom, a fluorine atom, a chlorine atom, a bromine atom, an iodine atom, a cyano group or an isothiocyanate group, the alkyl group or the alkenyl group is not substituted or can have one, two or more fluorine atoms, chlorine atoms, cyano groups, methyl groups or trifluoromethyl groups as a substituent, and one, or two or more methylene groups existing in the alkyl group or the alkenyl group may be substituted with -CO- or may be substituted with an oxygen atom or -COO- in such a manner that oxygen atoms are not directly bonded to each other,

P¹, P² and P³ each independently represents a 1,4-phenylene group, a 1,4-cyclohexylene group, a 1,4-cyclohexenyl group, a tetrahydropyran-2,5-diyl group, a 1,3-dioxane-2,5-diyl group, a tetrahydrothiopyran-2,5-diyl group, a 1,4-bicyclo(2,2,2)octylene group, a decahydronaphthalene-2,6-diyl group, a pyridine-2,5-diyl group, a pyrimidine-2,5-diyl group, a pyrazine-2,5-diyl group, a 1,2,3,4-tetrahydronaphthalene-2,6-diyl group, a 2,6-naphthylene group, an indane-2,5-diyl group, a phenanthrene-2,7-diyl group, a 9,10-dihydrophenanthrene-2,7-diyl group, a 1,2,3,4,4a,9,10a-octahydrophenanthrene-2,7-diyl group or a fluorene-2,7-diyl group, and the 1,4-phenylene group, the 1,2,3,4-tetrahydronaphthalene-2,6-diyl group, the 2,6-naphthylene group, the phenanthrene-2,7-

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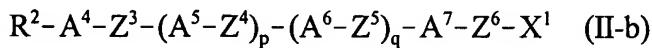
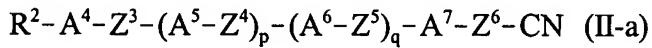
diyl group, the 9,10-dihydrophenanthrene-2,7-diyl group, the 1,2,3,4,4a,9,10a-octahydrophenanthrene-2,7-diyl group and the fluorene-2,7-diyl group are not substituted or can have one, or two or more fluorine atoms, chlorine atoms, trifluoromethyl groups, trifluoromethoxy groups or methyl groups as a substituent,

L^1 and L^2 represent a single bond, $-COO-$, $-OCO-$, $-C\equiv C-$ or an alkylene group having 2 to 5 carbon atoms in which one, or two or more methylene groups existing in the group may be substituted with $-CO-$ or may be substituted with an oxygen atom or $-COO-$ in such a manner that oxygen atoms are not directly bonded to each other, and the alkylene group is not substituted or may have one, or two or more fluorine atoms, alkyl groups having 1 to 5 carbon atoms, trifluoromethyl groups, trifluoromethoxy groups or phenyl groups as a substituent,

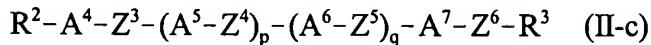
w is 0, 1 or 2, and when w is 2, the two groups P^1 or the two groups L^1 may be the same or different, and

at least one of R' , R'' , L^1 and L^2 is an optically active group,
wherein a natural pitch at 25°C is from 0.1 to 1000 μm .

15. (Withdrawn) The nematic or cholesteric liquid crystal composition according to claim 13, comprising one, or two or more kinds of compounds selected from the group consisting of compounds represented by the general formulas (II-a), (II-b) and (II-c):



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wherein R^2 and R^3 each independently represents an alkyl group having 1 to 10 carbon atoms or an alkenyl group having 2 to 10 carbon atoms, the alkyl group or the alkenyl group is not substituted or can have one, or two or more fluorine atoms, chlorine atoms, cyano groups, methyl groups or trifluoromethyl groups as a substituent, and one, or two or more methylene groups existing in the alkyl group or the alkenyl group may be substituted with $-CO-$ or may be substituted with an oxygen atom or $-COO-$ in such a manner that oxygen atoms are not directly bonded to each other,

A^4 , A^5 , A^6 and A^7 each independently represents a 1,4-phenylene group, a 1,4-cyclohexylene group, a 1,4-cyclohexenyl group, a tetrahydropyran-2,5-diyl group, a 1,3-dioxane-2,5-diyl group, a tetrahydrothiopyran-2,5-diyl group, a 1,4-bicyclo(2,2,2)octylene group, a decahydronaphthalene-2,6-diyl group, a pyridine-2,5-diyl group, a pyrimidine-2,5-diyl group, a pyrazine-2,5-diyl group, a 1,2,3,4-tetrahydronaphthalene-2,6-diyl group, a 2,6-naphthylene group, an indane-2,5-diyl group, a phenanthrene-2,7-diyl group, a 9,10-dihydrophenanthrene-2,7-diyl group, a 1,2,3,4,4a,9,10a-octahydrophenanthrene-2,7-diyl group or a fluorene-2,7-diyl group, and the 1,4-phenylene group, the 1,2,3,4-tetrahydronaphthalene-2,6-diyl group, the 2,6-naphthylene group, the phenanthrene-2,7-diyl group, the 9,10-dihydrophenanthrene-2,7-diyl group, the 1,2,3,4,4a,9,10a-octahydrophenanthrene-2,7-diyl group and the fluorene-2,7-diyl group are not substituted or can have one, or two or more fluorine atoms, chlorine atoms, trifluoromethyl groups, trifluoromethoxy groups or methyl groups as a substituent,

Z^3 , Z^4 , Z^5 and Z^6 each independently represents a single bond, $-CO-$, $-COO-$, $-OCO-$,

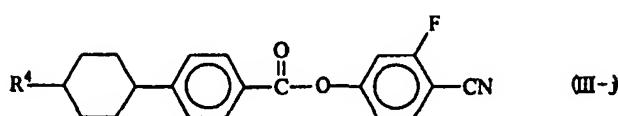
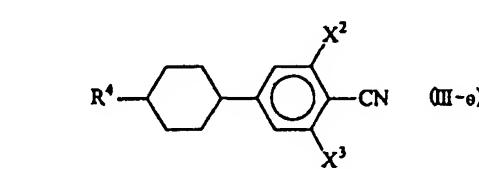
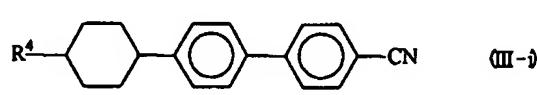
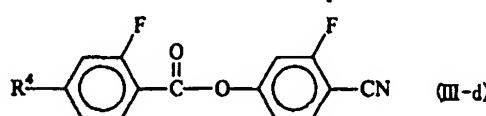
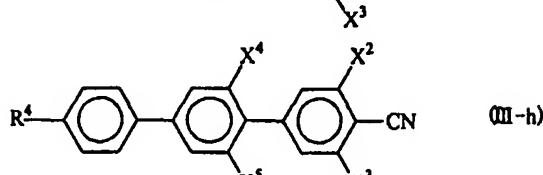
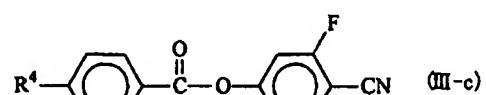
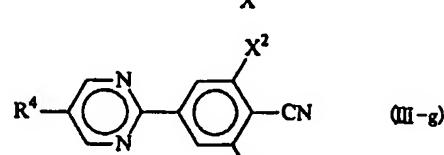
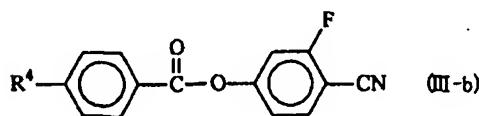
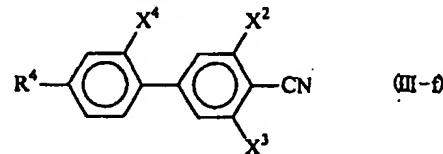
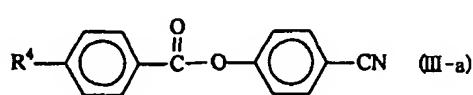
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$-\text{CH}=\text{N}-$, $-\text{N}=\text{CH}-$, $-\text{C}\equiv\text{C}-$, $-\text{CH}_2\text{CH}_2-$, $-\text{CH}_2\text{CH}_2\text{CH}_2-$, $-\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2-$, $-\text{CH}_2\text{O}-$,
 $-\text{OCH}_2-$, $-\text{CF}_2\text{O}-$, $-\text{OCF}_2-$, $-\text{CH}=\text{N}-\text{N}=\text{CH}-$, $-\text{CF}=\text{CF}-$, $-\text{CH}=\text{CH}-$, $-\text{CH}_2\text{CH}_2\text{CH}=\text{CH}-$,
 $-\text{CH}=\text{CHCH}_2\text{CH}_2-$ or $-\text{CH}_2\text{CH}=\text{CHCH}_2-$,

X^1 represents a fluorine atom, a chlorine atom, a trifluoromethyl group, a trifluoromethoxy group, a difluoromethoxy group or an isothiocyanate group, and

p and q each independently represents 0 or 1.

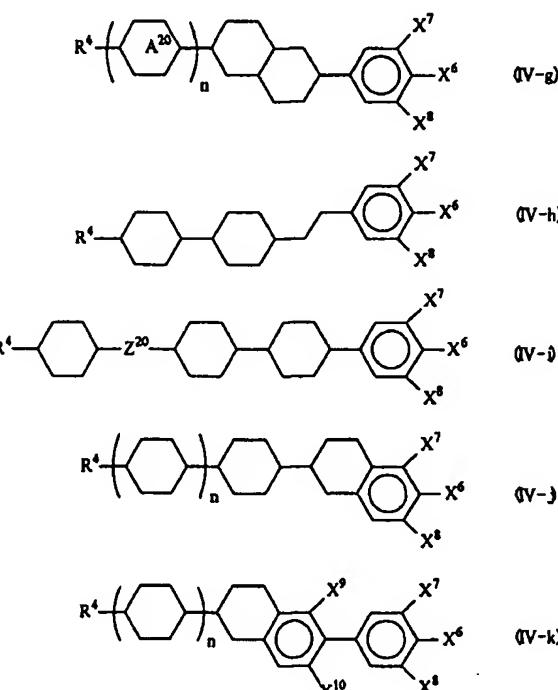
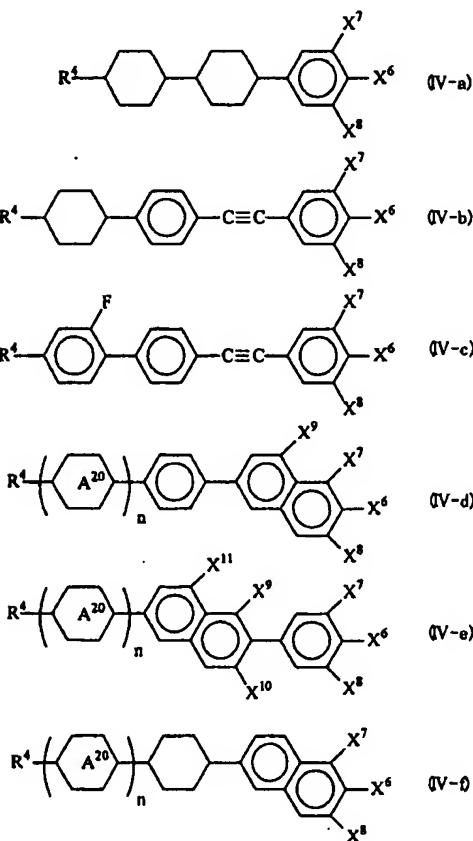
16. (Withdrawn) The nematic or cholesteric liquid crystal composition according to claim 15, comprising compounds selected from the group consisting of compounds represented by the general formulas (III-a) to (III-j):



wherein R^4 represents an alkyl group having 1 to 10 carbon atoms, an alkoxy group having 1 to 10 carbon atoms, an alkenyl group having 2 to 10 carbon atoms or an alkenyloxy group having 2 to 10 carbon atoms, and

X^2 , X^3 , X^4 and X^5 each independently represents a hydrogen atom, a fluorine atom or a chlorine atom.

17. (Withdrawn) The nematic or cholesteric liquid crystal composition according to claim 15, comprising compounds selected from the group consisting of compounds represented by the general formulas (IV-a) to (IV-k):



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wherein R^4 represents an alkyl group having 1 to 10 carbon atoms, an alkoxy group having 1 to 10 carbon atoms, an alkenyl group having 2 to 10 carbon atoms or an alkenyloxy group having 2 to 10 carbon atoms,

A^{20} represents a 1,4-phenylene group or a 1,4-cyclohexylene group,

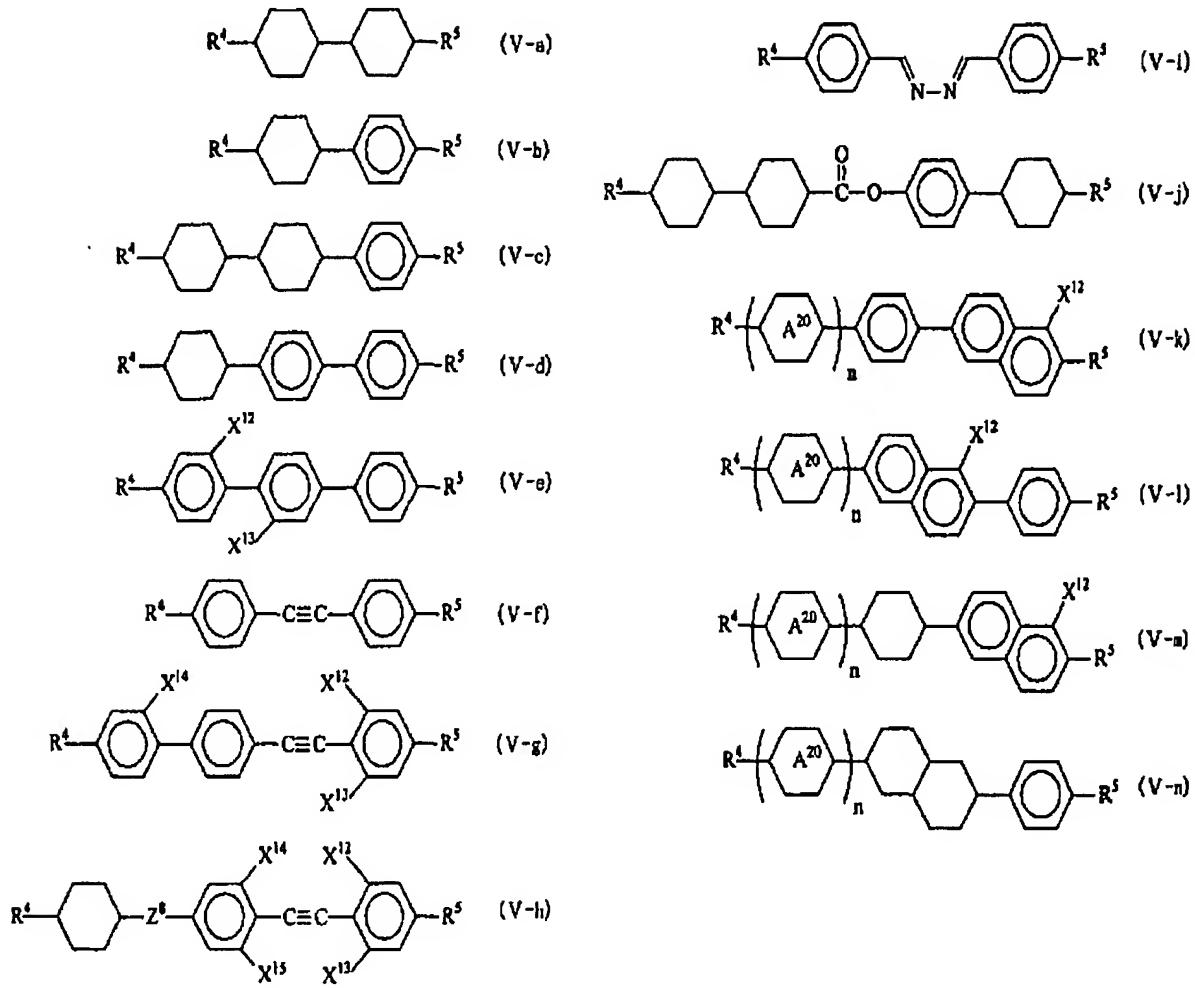
Z^{20} represents a single bond or $-\text{CH}_2-\text{CH}_2-$,

X^6 represents a fluorine atom, a chlorine atom, a difluoromethoxy group or a trifluoromethoxy group, and

X^7 to X^{11} each independently represents a hydrogen atom, a fluorine atom or a chlorine atom.

18. (Withdrawn) The nematic or cholesteric liquid crystal composition according to claim 15, comprising compounds selected from the group consisting of compounds represented by the general formulas (V-a) to (V-n):

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wherein R^4 and R^5 each independently represents an alkyl group having 1 to 10 carbon atoms, an alkoxy group having 1 to 10 carbon atoms, an alkenyl group having 2 to 10 carbon atoms or an alkenyloxy group having 2 to 10 carbon atoms,

A^{20} represents a 1,4-phenylene group or a 1,4-cyclohexylene group,

Z^8 represents a single bond, $-\text{CH}_2-\text{CH}_2-$ or $-\text{COO}-$, and

X^{12} to X^{15} each independently represents a hydrogen atom, a fluorine atom or a methyl group.

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19. (Withdrawn) A liquid crystal display device using the liquid crystal composition of claim 13.

20. (Withdrawn) A TN or STN liquid crystal display device using the liquid crystal composition of claim 16 or 18.

21. (Withdrawn) An active driving liquid crystal display device using the liquid crystal composition of claim 17 or 18.

22. (Withdrawn) A cholesteric liquid crystal display device using the liquid crystal composition of claim 16 or 18.